PROGRESS BOARD

BOOSTING INCOMES, CONFRONTING DEMOGRAPHIC CHANGE: BC'S "PRODUCTIVITY IMPERATIVE"

A Companion Discussion Paper to the Fifth Annual Benchmarking Report Released in December 2005 by the

BC Progress Board

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Executive Summary

The BC Progress Board, established by Premier Gordon Campbell in July 2001, is an independent panel of 18 senior business and academic leaders. The Board is tasked with benchmarking BC's economic and social performance over time and relative to other jurisdictions. The Board also provides strategic advice on ways to improve performance.

In past annual benchmarking reports, the Progress Board has highlighted the importance of productivity, discussing the Canada–US productivity gap, Canada's lagging productivity growth, and the inextricable relationship between productivity growth and improving income growth and living standards. The Board has also delved into the broad determinants of productivity growth, including business investment levels, the quality and nature of provincial infrastructure, research and development expenditures and intensity, and the number and quality of skilled workers along with other more narrow factors such as information and communications technology investment and intellectual property commercialization. Building on past work, this discussion paper examines the competitive and enabling conditions for productivity growth as a driver of province-wide economic growth and, consequently, as a catalyst for improving overall living standards for British Columbians. In doing so, the paper focuses attention on several framework policy areas to encourage productivity growth in British Columbia.

The importance of productivity growth to the overall prosperity and quality of life in British Columbia stands behind the Progress Board's desire to keep the topic at the top of mind in deliberations of policymakers in all orders of government, business and community interests, and the public at-large. British Columbia's mediocre productivity performance – 6th in Canada for real GDP per hour worked in the business sector in 2004 – is also a motivation. Relative to the national average rate for 2004, British Columbia lags (slightly) behind at 96.9 percent of Canada's level. A related factor is BC's relatively weak export sector. In 2004, BC posted 8th rank among the provinces for exports of goods and services per capita. Solid business investment and greater export exposure ultimately provide the backdrop for improved productivity performance and rising incomes in Canada, and in British Columbia.

In its simplest terms, productivity and productivity growth determine how much a jurisdiction can produce given finite resources – a stable and finite amount of labour and workable hours, in combination with capital resources such as land, natural resources such as oil and gas, and machinery and equipment. Growing productivity, through investing in physical capital and in people, stimulating innovation, and/or specializing in more productive industries is the primary method to encourage macro-level economic growth. By jump-starting our mediocre productivity and growing it past the national average, BC can become a national leader in investment, innovation, and in living standards. This is not to suggest the task will be easy. British Columbia's industrial mix is weighted towards labour-intensive service industries and the preponderance of firms are small and medium sized. And, the sectoral mix of BC is highly dependant on natural resources, which is not entirely flexible. On a micro or individual level, becoming more productive – through training, new techniques and learning from skilled co-workers – means a worker can demand a higher wage, and consequently improve their relative individual or family standard of living. Productivity and productivity growth is therefore important to economic well-being at a province-wide level, at the sector or firm level, and at the individual level.

In order to effect further improvements in material living standards in British Columbia, public and firm-level policies and practices must continuously be reviewed for their contribution to making BC enterprise more productive. Productivity is a very complex topic and there is not complete agreement among experts on precise prescriptions to improve performance. And it is important to remember that

investments which are likely to yield productivity improvements can take some time to pay off. Having said this, in the BC context there are a variety of practical suggestions which policy makers can consider to help boost overall productivity performance over time. Based on previous work and analysis within this report, the Progress Board suggests that broad efforts can usefully be concentrated in five areas: tax policy; trade barriers, openness, and immigration; regulatory reform; public infrastructure; and, skills, education and research.

- **Tax Policy**
  - Ongoing efforts to shift the tax burden away from investment with continued efforts to lower the marginal effective tax rate on capital investment are imperative. On the international scale, top economic growth performers such as Singapore and Ireland have much lower rates. Within Canada, a low marginal effective tax rate on capital has helped propel productivity growth in Newfoundland and Labrador between 1997 and 2004.
  - Mindful of the provincial government's current provincial sales tax review, the province should examine the feasibility of harmonizing the provincial sales tax with the federal goods and services tax to reduce compliance costs for businesses as well as eliminate sales tax on business inputs.
  - Provincial corporate taxes should continue to be neutral to all industries to ensure the competitive market can function effectively to encourage the growth of highly productive sectors and firms.
  - Efforts to review the impact of the provincial property tax regime on industrial competitiveness, particularly within the province's regional economies should be a priority.

- **Trade Barriers, Openness, and Immigration**
  - Ongoing efforts to reduce international and remaining inter-provincial barriers to trade should be a priority. Though few, remaining inter-provincial barriers that limit labour mobility should be eliminated. These include:
    - Areas of limited transferability of work-related benefits; and,
    - Professions for which there are no mutual recognition agreements of qualifications between provinces.
  - Programs aimed at integrating new skilled immigrants into the British Columbia workforce should be encouraged, including:
    - Credential assessment programs that assist employers in evaluating foreign education and training;
    - Bridge programs to "top-up" immigrant skills and language training, among others; and,
    - Leverage, to the greatest extent possible, the provincial nominee program to help address existing and prospective skilled trade shortages.
  - Further proactive efforts by both British Columbia and federal authorities to address visa processing challenges to encourage foreign students to study and stay in Canada should be a priority.
  - Further efforts by federal authorities to develop more multi- and bi-lateral trade agreements, like NAFTA, to further integrate BC and Canada into the global economy should be a priority.

- **Regulatory Reform**
  - Coordination and wherever possible harmonization of regulatory standards across agencies within government and across all orders of government (federal, provincial and local) should be aggressively pursued.
  - While past BC reform efforts have targeted a reduction in the quantity of regulation, future reforms should aim to improve the quality of regulation to ensure minimal impacts on the efficient functioning of markets and productivity growth.
  - Provincial efforts should be targeted initially at high impact areas including land use and environmental regulation.
  - The province should track and report regularly on regulatory enactments made by local governments under the Community Charter.
  - Similar to efforts in other provinces, BC's mandatory retirement policy should be reviewed.
- **Public Infrastructure**
  - Because most infrastructure is managed at the local level (more than 50%), the province should continue to work with local governments to target the most necessary and urgent projects in terms of their ability to boost provincial productivity.
  - Federal and provincial authorities should continue investments in critical Airport infrastructure province-wide, particularly in selected urban and regional nodes where such investments can have transformative effects from both passenger and cargo standpoints.
  - Consistent with past Progress Board policy suggestions, the province and federal government should continue efforts to four-lane key North-South and East-West highway infrastructure, particularly the Trans-Canada and Highway 97 from Prince George to the Canada-US Border
  - Continue planned provincial and federal gateway transportation improvements in the Lower Mainland (port, roads, rail, and air), twinned wherever feasible with Transportation Demand Management Techniques to improve the flow of consumer goods and services and people.
  - Efforts should be taken to align regional transportation and land use planning (zoning) to increase ridership on Skytrain lines to further productivity and sustainability within the Greater Vancouver Region as a whole.
- **Skills, Education, and Research**
  - Continue to focus efforts on early childhood education to ensure the next generation is prepared to fully contribute to the province.
  - Continue to focus on enhancing adult basic literacy.
  - Provincial authorities should develop and make widely available materials outlining productivity enhancing measures that individuals and firms can implement in their daily lives, including but not limited to: incentive and bonus schemes; use of more flexible work arrangements; and, adjustments to pension provisions to provide incentives for working past age 60.
  - Continue to focus on achieving a leadership position relative to other provinces in terms of provincial high school completion and test results, including:
    - Pay particular attention to reducing performance outcome gaps between Aboriginal students and the general student population;
    - Address growing student performance gaps between female and male students;

and,

- Focus additional efforts on smoothing out regional variations in high school completion results.

- Focus on Post-Secondary Education and Research
  - Focus on maintaining British Columbia's leadership position with respect to the percentage of persons of working age with a post-secondary credential;
  - Focus on increasing British Columbia's provincial graduate student enrolments generally, and those in applied sciences and engineering disciplines in particular;
  - Continue concerted efforts to address skilled trade and other worker shortages through training, immigration and other means;
  - Continue efforts to encourage firm level adoption and diffusion of information and communications technology;
  - Continue efforts to improve British Columbia's relative performance on public and private research and development expenditures;
  - Develop and aggressively pursue a province-wide strategy to commercialize research from BC's post-secondary institutions; and,
  - Examine and act on areas where the province can benefit most from the integration of foreign credentialed immigrants into the provincial workforce.

British Columbia needs to become seized with the task of building a "culture of productivity" as a collective provincially, in public policy decisions of all orders of government, within business planning and daily decision making in firms and organizations, and within our own decisions as individual citizens. The reality of demographic change and its consequences for provincial labour markets and, ultimately, our ability to fund public services in the coming decade suggests that "pulling out all the stops" to boost productivity performance must be a provincial priority.

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I. INTRODUCTION – SETTING THE CONTEXT

Productivity is very important. On a country or province-wide basis, productivity levels determine how much a jurisdiction produces given their natural resources, available capital, and labour force. For a business, surviving in competitive markets means being as productive as possible; that is, producing as much output per unit of capital and labour as possible. For an individual worker, productivity levels ultimately determine the wage they can demand in a market. And at a broad societal level productivity growth holds the key to funding critical public services such as infrastructure, health care, education and other social services that are fundamental to a high quality of life. Simply put, productivity growth is a vital component of increasing economic prosperity not only in business, but also for individuals within society at large.

During the past few years, British Columbia's overall economic performance has seen a marked improvement. For three years running (2002-2004), British Columbia's real gross domestic product per capita has performed better than the national average (see Chart 1). The provincial job creation record has also improved, with unemployment across the province standing at 30 year lows. The past couple of years has also seen a fairly significant commodity price uptick which has helped spur an economic renaissance in all regions of the province. Other key economic indicators also convey a sense that the province has rebounded from the doldrums of the late 1990s and early 2000s. Though the turnaround is remarkable, it should not be taken for granted. In fact, the Progress Board views the current economic boom as a critical opportunity to "set the table" for sustained future economic growth. At the root of these efforts, is the need for a concerted focus on improving BC's mediocre productivity track-record.

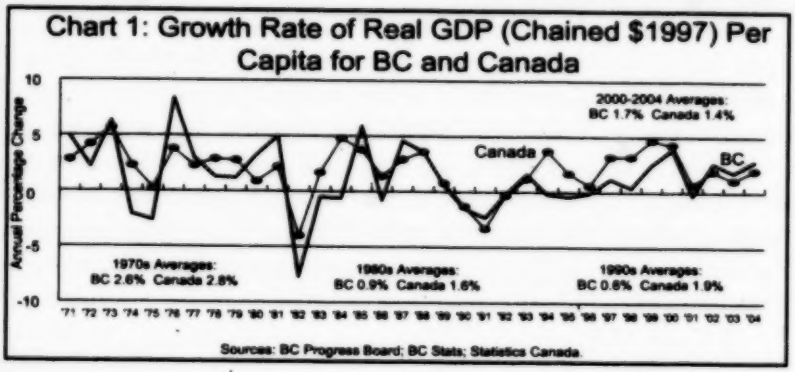
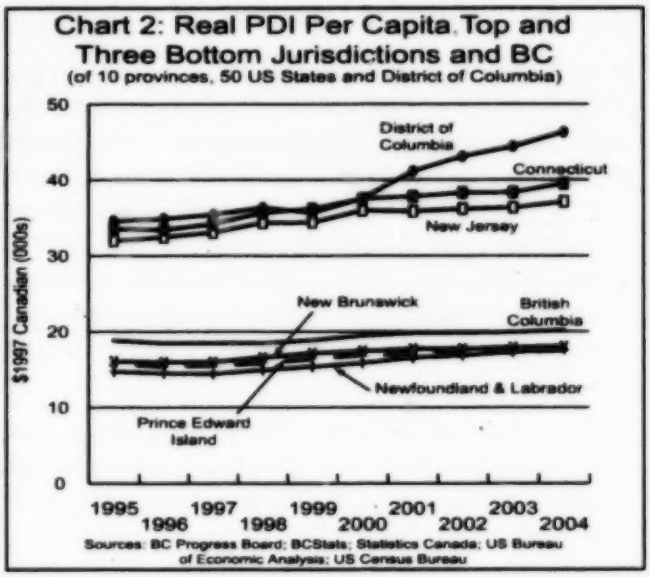


Chart 1: Growth Rate of Real GDP (Chained $1997) Per Capita for BC and Canada
Annual Percentage Change
10
5
0
-5
-10
2000-2004 Averages:
BC 1.7% Canada 1.4%
Canada
BC
1970s Averages:
BC 2.6% Canada 2.8%
1980s Averages:
BC 0.9% Canada 1.6%
1990s Averages:
BC 0.6% Canada 1.9%
'71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04
Sources: BC Progress Board; BC Stats; Statistics Canada.

Productivity growth is the primary and direct means of increasing Gross Domestic Product (GDP) per capita, the most common overall economic measure of a country's standard of living. Labour productivity growth accounted for 80 percent of the growth in Canada's standard of living from 1961 to 2004.[1] Over the past decade, there is ample evidence that British Columbia's productivity performance lagged; BC was 6th in Canada for GDP per hour worked in the business sector in 2004, and 8th among the provinces for improvement between 1995 and 2004. The province's at best mediocre productivity performance cascades through to provincial income growth where BC has also lagged. Though it has improved in the past few years, personal after-tax income per capita has underperformed the national

average in British Columbia since 1998. In 2004, while BC had the 3rd highest personal disposable income per capita in Canada at $20,182, it placed behind Alberta ($23,652) and 2nd placed Ontario ($21,883). The picture is much less favourable when BC is benchmarked relative to US states, where the province ranks 54th out of 61 provinces, US states and the District of Columbia in 2004 as shown in Chart 2.[2]

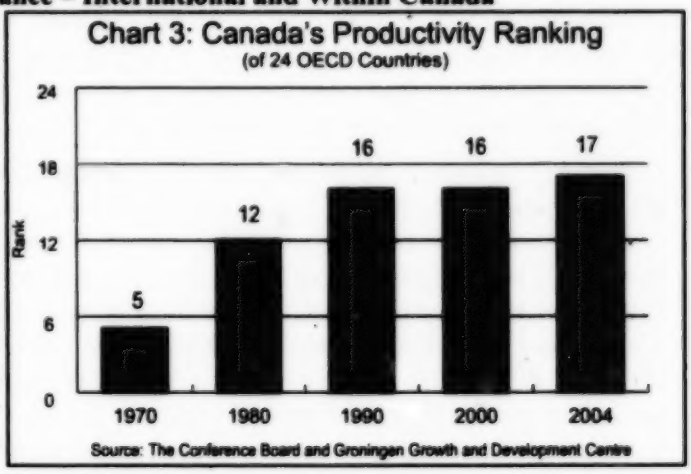


The discussion that follows begins by providing a snapshot of the comparative state of productivity growth and levels in British Columbia relative to Canada, other provinces, and on a sector-by-sector basis. The next section discusses the link between labour productivity growth and raising living standards. The paper then explores a number of determinants that underpin productivity growth, including physical capital investment, investment in skills, training and education, and innovation, as well as supplementary factors including economies of scale and information and communications technology investment, among others. The final section of the paper provides the Progress Board's suggested five areas for improving productivity performance, personal incomes and overall British Columbia standards of living.

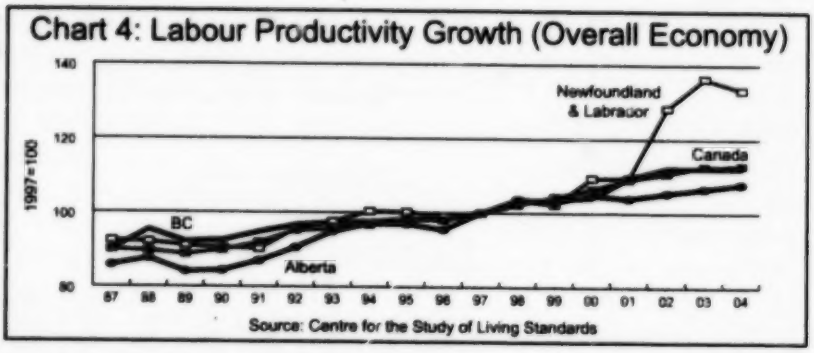
II. COMPARING BC'S PRODUCTIVITY PERFORMANCE[3]

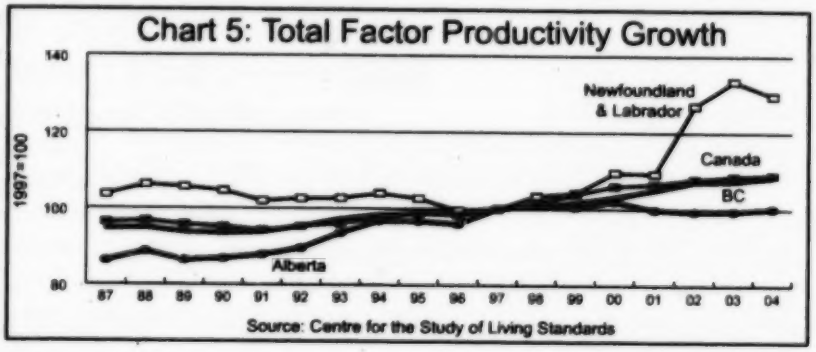
Overall Productivity Performance – International and Within Canada

Looking first at the international context, Canada has consistently experienced declining relative productivity since its strong performance in the 1970s (see Chart 3). Indeed, Canada slipped from 5th place to 17th within the OECD by 2004. Canadian productivity growth has declined in absolute terms as well, from an annual average rate of 3.6 percent over the 1960s to 1.8 percent in the



1990s, to under one percent from 2000 to 2004.[4]





Overall productivity growth in British Columbia, after falling below Canadian rates for both labour and total factor productivity[5] has rebounded to be approximately the same rate as Canada since 2002. The long-term growth of BC's labour and total factor productivity is detailed in Charts 4 and 5. In simple terms, *labour productivity* is a ratio of GDP to a single input, labour (measured as population, number of workers or hours worked). *Total factor productivity* (TFP) is a ratio of GDP with respect to all inputs, not just labour. Most reports focus on labour productivity because the data are more readily available and comparable across jurisdictions. (See Annex 1 for more detail).

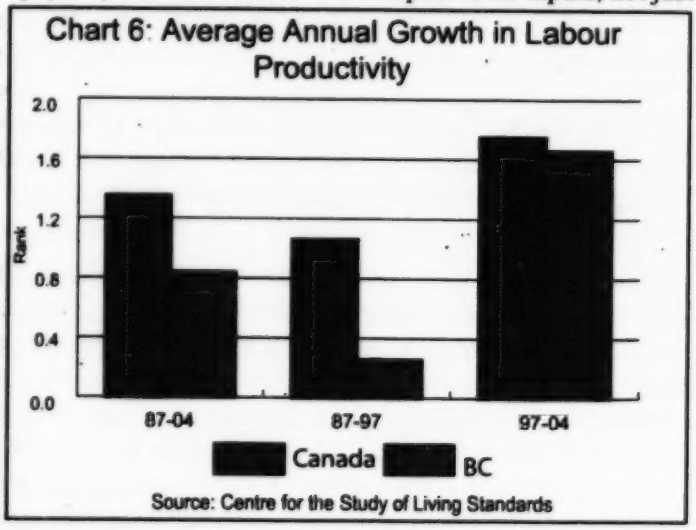
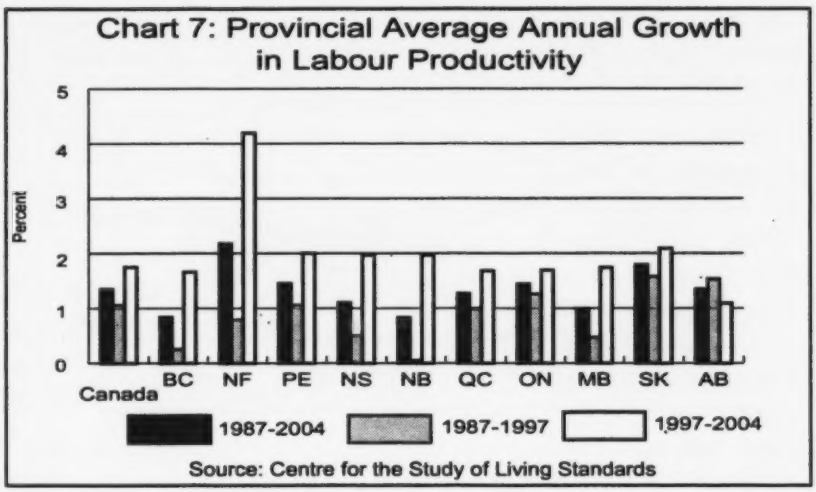


Chart 6 compares labour productivity growth in BC and Canada over the period 1987-2004. BC's growth over the period was on average 0.5 percent lower than Canada's, with the gap largely attributable to low relative labour productivity growth in the period 1987-1997. Since 1997, BC's average annual labour productivity growth has been just one tenth of a percent lower than Canada's overall.

Relative to other provinces, BC ranked 9th in labour productivity growth over the period



from 1987 to 2004 ahead of bottom ranked New Brunswick. As well, British Columbia ranked second-to-last in the sub-periods of 1987-1997 and 1997-2004. While BC's labour productivity growth was very low (0.26%) relative to provinces such as Ontario (1.26%), Quebec (0.99%) and Alberta (1.54%) over 1987-1997, at 1.66 percent it was higher than Alberta's (1.09%) and even with Ontario (1.69%) and Quebec (1.68%) over 1997-2004. In fact, during 1997 to 2004, all provinces were within one half of one percent in terms of labour productivity growth rates, except Alberta which was lower than average and Newfoundland and Labrador which registered above average annual labour productivity growth levels of over four percent, as shown in Chart 7.

In sum, Canada's productivity growth performance has been declining internationally relative to competitor nations within the OECD, and within Canada, BC's overall productivity growth has been, at best, mediocre. For both British Columbia and Canada, there is considerable room for improvement.

Industry Level Productivity – Canada and the Provinces

While the previous section focuses on comparative growth rates, comparing productivity *levels* across sectors and jurisdictions can provide some insight into efficiency both across industries and across provinces within the same industries.[6]

British Columbia had a labour productivity advantage within Canada in several industries and industry groups, but had a slight disadvantage overall in 2004. BC's real GDP per hour worked was 96.9 percent of Canada's, but was especially low relative to the national average in certain manufacturing industries such as clothing manufacturing (51.5%) and miscellaneous food manufacturing (59.0%). However, BC's manufacturing industry category as a whole was 96.4 percent of overall levels for Canada, buoyed by strong performances in wood product manufacturing (147.3%), meat product manufacturing (149.3%), and high relative labour productivity in computer and peripheral equipment manufacturing (192.6%) and miscellaneous non-metallic product manufacturing (201.0%).

British Columbia had a productivity advantage, relative to Canada, in several industry categories in 2004, including: the catch-all category of agriculture, forestry, fishing & hunt-

ing; mining & oil and gas extraction; and, transportation and warehousing. A highly productive industry in BC vis-a-vis Canada is forestry and logging, at 159.9 percent of the Canadian average in 2004, and it performed between 119.5 and 164.9 percent of the Canadian average for the period from 1987 to 2004. For 2004, BC had a productivity disadvantage in the industry categories of construction, wholesale trade and professional, scientific and technical services among others.

Table 1: BC's Labour Productivity as a percent of Canada's, 2004, Selected sectors and sub-sectors

BC's productivity advantage	
Agriculture, Forestry, Fishing & Hunting	162.2
*Forestry and logging	159.9
Mining & Oil and gas extraction	145.0
Transportation & Warehousing	112.1
Manufacturing	96.4
*Wood product manufacturing	147.3
*Computer and peripheral equipment manufacturing	192.6
BC's productivity disadvantage	
Construction	83.6
Wholesale Trade	92.8
Professional, scientific and technical services	79.0
Manufacturing	96.4
*Clothing manufacturing	51.1
*Misc. food manufacturing	59.0

Source: Centre for the Study of Living Standards **Note:** *sub-sector.

Overall, British Columbia ranked 4th out of ten provinces in GDP per hour worked at 91.0 percent of top ranked Alberta, 93.2 percent of Ontario, and 96.9 percent of Newfoundland and Labrador. BC's overall labour productivity level has remained relatively constant over the past few years, as have levels in Alberta, Ontario, Quebec, Nova Scotia and New Brunswick. Prince Edward Island and Saskatchewan have seen relatively high productivity gains, while Newfoundland and Labrador's labour productivity has risen by 18 percent since 2001.

Table 2: Sector Level Productivity Rank, BC versus Other Provinces

Industry	*Rank*
Agriculture, Forestry, Fishing & Hunting	1st
Utilities	1st
Mining and Oil and Gas Extraction	2nd
Retail Trade	2nd
Transportation and Warehousing	3rd
Arts, Entertainment and Recreation	4th
Admin. and Support, Waste Mgmt and Rem. Serv.	4th
Professional, Scientific and Technical Services	5th
Finance, Insurance, Real Estate etc...	5th
Wholesale Trade	5th
Manufacturing	5th
Accommodation and Food Services	5th
Construction	8th
Information and Cultural Industries	10th

Source: Centre for the Study of Living Standards

In 2004, British Columbia ranked 1st in labour productivity in the sector of agriculture, forestry, hunting and fishing, supported mainly by an absolute labour productivity advantage in forestry and logging, ranging from 109.7 percent of Saskatchewan's productivity level to 294.6 percent of Nova

Scotia's (see Table 2). BC held specific sub-sector productivity advantages in wood product manufacturing, oil and gas extraction and computer and peripheral equipment manufacturing. Relative to the rest of the Canadian provinces British Columbia's labour productivity was ranked a low 8th in the construction sector, at 67.1 percent of top ranked Quebec. British Columbia ranked 10th in information and cultural industries, with an average of 73.7 percent of the other provinces' level of GDP per hour worked. BC had the 3rd best level among the provinces in transportation and warehousing. BC placed 4th for arts, entertainment and recreation. Meanwhile, BC ranked in the middle of the pack (5th) in: manufacturing; wholesale trade; financing, insurance, real estate and renting and leasing; professional, scientific and technical services; and, accommodation and food services.

A Further Look at British Columbia Sector Performance

Just as the industry mix of an economy has an impact on aggregate levels of labour productivity and productivity growth, the characteristics of a sector or industry are critically important – whether it produces goods or services, is export or import oriented, the degree of competition it faces, the size and concentration of the industry, average firm size, its adoption and development of innovation over time, and the amount of investment in machinery and equipment that exists.

Table 3: Average Annual Growth (percent) in Labour Productivity for Canada and BC

	Canada			*BC*		
	87-04	87-97	97-04	87-04	87-97	97-04
Overall	1.65	1.06	1.75	0.84	0.26	1.66
Forestry and Logging	(0.23)	(3.48)	4.59	0.23	(2.73)	4.60
Wood Product Manufacturing	0.15	(0.76)	1.46	(0.18)	(2.90)	3.84
Pulp, Paper and Paperboard Mills	1.73	0.17	4.00	0.91	(4.33)	8.90
Construction	0.04	(0.37)	0.63	(0.90)	(0.93)	(0.86)
Mining and Oil and Gas Extraction	1.52	1.73	1.21	5.78	5.04	6.83
Agr., Forestry, Fishing and Hunting	3.36	1.83	5.59	0.56	(1.04)	2.89
Manufacturing	1.99	2.09	1.84	0.47	(1.66)	3.60
Wholesale Trade	3.11	3.26	2.89	3.91	2.47	6.00
Retail Trade	1.83	0.59	3.62	1.76	0.33	3.85
Finance, Ins., Real Estate etc...	2.45	2.05	3.03	2.39	1.80	3.23
Computer and Per. Equip. Manu.	21.99	24.66	18.28	15.94	18.19	12.79

Source: Centre for the Study of Living Standards

British Columbia had labour productivity growth higher than the national average in the mining and oil and gas sector (5.8%) and in wholesale trade (3.9%) over the entire period 1987-2004, and in retail trade (3.9%) and manufacturing (3.6%) for 1997 through 2004. In the computer and peripherals equipment manufacturing sub-sector, labour productivity grew by almost 16 percent per year over the entire period, though it was below the Canadian level of 22.0 percent average growth per year. Table 3 details Canadian and British Columbia sector productivity growth over the entire period of 1987-2004, and the sub-periods of 1987-97 and 1997-2004.

In mining and oil and gas, the Canadian labour productivity growth average was pulled down by Alberta, which had losses in labour productivity of more than three percent per year over the period 1997-2004. This highlights one of the many complications in analys-

ing productivity – investments which are likely to yield improvements can take some time to pay off. In this case, although the industry is in a healthy state in terms of profitability, productivity may be in decline as higher energy prices increase the drive towards exploiting more costly reserves which tend to lower productivity in the shorter term.[7] This is why the highly profitable Alberta mining and oil and gas sector had negative productivity growth over 1997-2004, and may be behind BC's relatively high performance in the sector versus Canada as a whole. Like most investments, the development of new processes and equipment in mining and oil and gas doesn't translate into immediate productivity gains, as there is often a lag between an investment and the realization of the impact of the investment in production. However, productivity gains from current large-scale investments in the development of oil sands should materialize within the next decade.[8]

BC's solid productivity growth performance in the agriculture, forestry, fishing and hunting sector is important for overall provincial productivity performance and economic growth, as the sector made up 4.1 percent of BC GDP in 2004. Other strong productivity performers that represent a significant part of BC's economy include wood product manufacturing (3.7% of 2004 GDP) and transportation and warehousing (6.4%). Boosting productivity in under-performing sectors – such as construction, which accounted for 11.9 percent of BC GDP in 2004 – would help to improve overall provincial performance, though there may be natural limits to increases because of the labour-intensive nature of some of these sectors.

III. THE IMPORTANCE OF PRODUCTIVITY GROWTH FOR RAISING LIVING STANDARDS

Labour productivity is often measured using a ratio of GDP per hour worked for a particular population.[9] GDP per capita is a commonly used and widely recognized measurement and comparison tool used to evaluate a jurisdiction's standard of living over time and against others. The link between labour productivity growth (GDP per hour worked) and a rise in the standard of living (GDP per capita) can be see through the equation below.[10]

Table 4: Labour Productivity Growth and the Standard of Living

$\frac{GDP}{Pop}$	=	$\frac{GDP}{HR\ Wrkd}$	X	$\frac{HR\ Wrkd}{Emp}$	X	$\frac{Emp}{LF}$	X	$\frac{LF}{Population}$
Standard of Living	=	Labour Productivity	X	Work Intensity	X	Employment Rate	X	Demographic Element

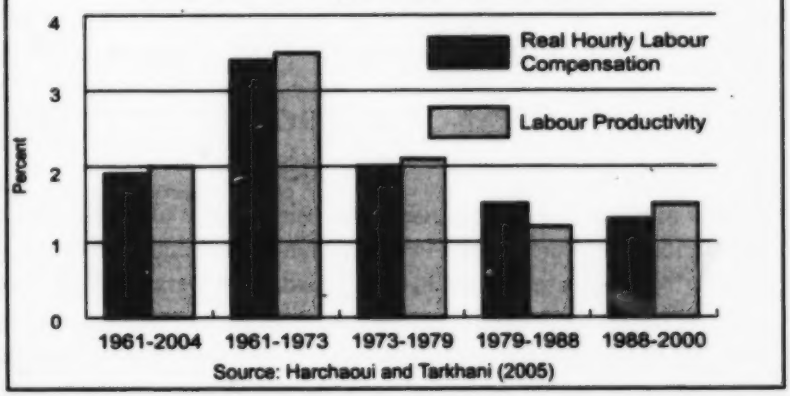
Sources: BC Progress Board; Orr (2005); Institute for Competitiveness and Prosperity (2005a)

From this, it is evident that any increase in the standard of living has to come from either growth in labour productivity (measured as GDP per hour worked) or increases in the labour force, employment rate, or the average number of hours worked. The demographic element above represents the proportion of the total population that is working or actively looking for work, and fluctuates depending on many economic factors and population char-

acteristics.[11] Because the demographic element is a ratio, it cannot exceed 100 percent (for example, in BC the size of the labour force fluctuated between 50 and 53 percent of the total population over the period 1985-2004). The employment rate as well cannot exceed 100 percent, meaning no more than 100 percent of those in the labour force can be employed (BC employment rates fluctuated between 85 and 93 percent over the 1985-2004 period). There is also a definite limit to the amount of hours that can be worked by any one person or population in a set period of time. In this connection, it is interesting to observe that British Columbians have decreased the average number of hours they work from 1,736 in 1990 to 1,677 in 2003. Growth in any of these factors, due to their finite quality, may improve labour productivity growth levels for a period of time, but this cannot be sustained over the longer term. The only long run method to improve standard of living, and thereby to increase the amount of GDP per capita in a jurisdiction, is to grow labour productivity.[12]

As mentioned earlier in this paper, a recent Statistics Canada report assigned 80 percent of the increase in Canada's living standards from 1961 to 2004 to labour productivity growth. The other 20 percent came from increases in the amount of hours worked overall in the economy. Average annual labour productivity growth of 2.0 percent during the 1961 to 2004 period resulted in real GDP per person which was 2.9 times higher in 2004 than in 1961. The report also linked labour productivity growth and income distribution, and highlighted the connection between gains in labour productivity and similar growth of real hourly compensation of workers (see Chart 8).[13]

Chart 8: Labour Productivity and Real Hourly Labour Compensation, Canada

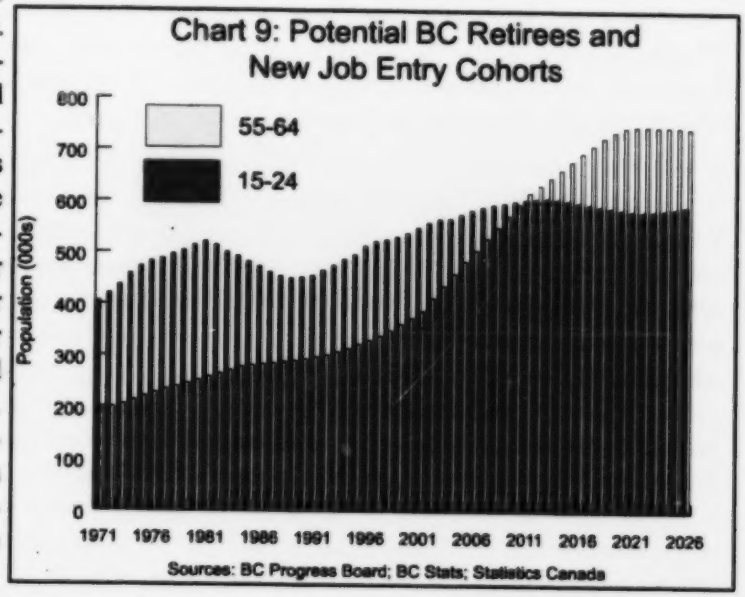


Source: Harchaoui and Tarkhani (2005)

As the amount of time worked and the percentage of the population participating in the labour force has waned in recent years in advanced industrialized countries, labour productivity gains have become all the more important to ensure real standards of living in jurisdictions like Canada and British Columbia don't decline. Between 1946 and 2002, for example, growth in labour productivity accounted for 117% of GDP growth per capita.[14] This means that labour productivity growth negated some of the effects of the labour participation slowdown during the same period and was the principle driver of real economic growth.

Looking forward, British Columbia and Canada, along with many other developed economies, will be faced with an older population due to the ageing of the baby boom generation. An ageing population has the potential to increase the demand for social services, especially

health care and income support, while at the same time shrinking the labour force. The long-term trend in BC is for the percentage of workers over the age of 49 to continue to rise until 2016, when it reaches 30 percent of the workforce. At this point close to one-third of the workforce will be on the verge of retirement. The impact of this trend on the labour force is magnified by the downward trend of those under age 30 present in the labour force (due to both lower fertility and prolonged post-secondary education). By 2011, the outflow of retirees is expected to surpass the inflow of young workers entering the workforce (see Chart 9).



Unless the decrease in the 'demographic element' of the equation discussed previously and as illustrated in Chart 9 is offset, there could be a negative impact on British Columbian's standard of living. Indeed, one recent study suggests that unless there are significant productivity gains during the coming decade, BC's economic growth rate is likely to decline from current levels of 2.5 - 3.0 percent to 1.0 - 1.6 percent by 2020.[15] A host of policy measures may be able to at least partially obviate the effect. Among measures that could be contemplated: targeting an increase in the inflow of workers from other provinces and countries by increasing the transferability of credentials and training across borders; examination of mandatory retirement policies; use of more flexible work arrangements; and, alterations to pension agreements that include incentives for working past age 60.[16] Apart from these demographic-specific measures, general policies that promote productivity growth could mitigate against whatever impact these age-related factors will have on overall standards of living in British Columbia and Canada. We examine the primary drivers of productivity growth in the context of policies to promote productivity in the next section, along with some related secondary factors.

IV. PRODUCTIVITY GROWTH DRIVERS – TOWARD IMPROVED BRITISH COLUMBIA PERFORMANCE

There are many factors that contribute to gains in both labour and total factor productivity. The broad, primary drivers include investment in physical capital and people, technological innovation and the popularization of innovation. At the firm level, primary drivers include industry size and the related economies of scale.

British Columbia is a small, open, trade-dependent economy with a contribution to North American GDP that is less than one percent of the total. The foundation of productivity growth at the ***jurisdiction level*** is an open, competitive market, with tax policies that are fair and non-intrusive, regulatory policies that do not impede the productive functioning of business, and free trade policies and agreements that allow for goods and services to move with ease across provincial and international borders. Along with this economic base, infrastructure – strong and effective transport, utility and communication systems – is a necessary precondition for productivity growth. This foundation provides a healthy environment for private investment from both domestic and foreign sources, physical capital, and the education of a highly skilled and capable labour force. These crucial investments lead to higher levels of innovation of both products and processes, which in turn creates higher productivity, economic growth, and the creation of a "virtuous cycle" to fund further investment, innovation, commercialization and popularization of new technologies and processes, and, of course, further productivity growth. Growth in productivity at an aggregate or economy-wide level is influenced by the coexistence of these factors within a jurisdiction.

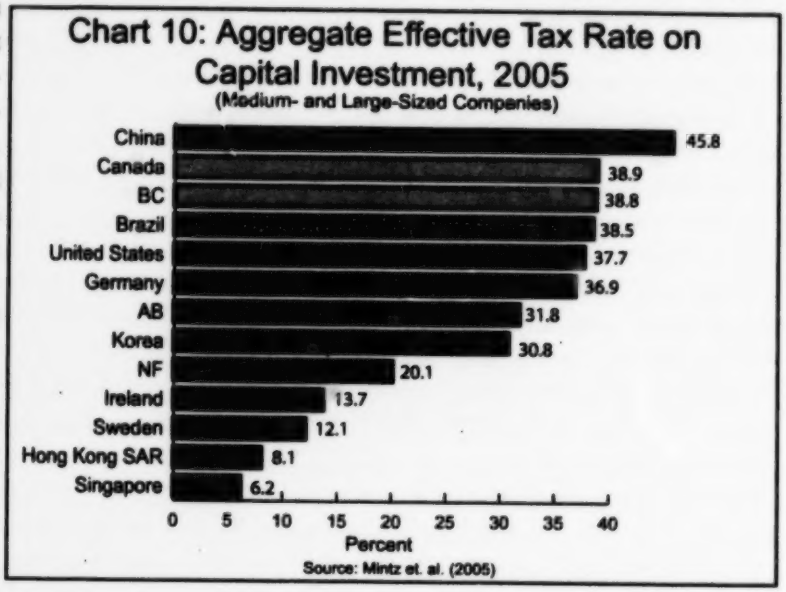
Other ancillary determinants of productivity and productivity growth exist at the ***sector*** or ***firm level***, including industry organization and economies of scale which influence what makes a particular firm or industry sector productive. These also have an effect on aggregate productivity growth, depending on the composition of the particular economy. Further, the mix of industries present in a jurisdiction, how the labour force is allocated amongst industries and firms, and how that allocation changes over time, has a direct impact on productivity growth.

Capital investment, ***technological innovation*** and improvements in the general level of ***human skills and education*** in the population are often identified as the three most important determinants of labour productivity growth.[17] Other researchers have ranked the main sources of productivity growth differently, citing openness to trade and investment, along with investment in machinery and equipment and human capital development as the top sources of both total factor and labour productivity growth.[18] There is significant overlap amongst these drivers; capital investment and investment in machinery and equipment are one and the same, while improvements in skills and education can be equated with human capital development.

Starting with the necessary government policy foundations, the following section outlines each determinant beginning with those that exist at the Canada/BC-wide level, followed with those determinants that work specifically at the sector and firm level.

Some Key Public Policy Foundations

Productivity measures the efficiency of the business sector in producing goods and services; it is primarily the actions of business that drive growth in productivity, not government. Having said this, though, the ability and willingness of business to improve productivity – through investment in machinery and equipment, human resources, and the cultivation of product and process innovation – is based upon the fiscal and policy framework put in place by federal, provincial and local governments.[19]



At its foundation, governments should promote fair, competitive markets that demand productivity in order for business survival. By taxing neutrally and reducing subsidies of less competitive firms, government promotes the strengthening of profitable industries and encourages productivity growth as resources are reallocated to the more productive industry. Reducing trade barriers, both inter-provincially and internationally, means that Canadian producers can build productivity by increasing economies of scale, which in turn helps them to invest and innovate as they adapt more productive processes in order to compete globally.[20]

As it stands, Canada has the second highest ***effective tax rate on capital*** amongst 36 countries in 2005 at 38.9 percent, second only to China with 45.8 percent. The principal driver behind this high relative rate are capital taxes and sales taxes on capital inputs, meaning Canada taxes capital investment at a high rate compared with international competitors. Notably, Canada's rate is over one percentage point (and three percent) higher than the US, its closest competitor for mobile international capital investment. Within Canada, British Columbia's effective tax rate on capital is the 4th highest at 38.8 percent, almost twice Newfoundland and Labrador's rate of 20.1 percent. Alberta's rate is 7.0 percentage points lower than BC's, at 31.8 percent[21] (see Chart 10).

The current tax system in Canada also discriminates between sectors. Construction, communications, wholesale and retail trade, and household and business services are taxed highly – large corporations in these sectors pay rates over 40 percent – while primary forestry,

manufacturing and public utilities pay much lower rates. Different types of business investments are also taxed at varying rates. Investments in structures are taxed at 42.0 percent, machinery at 38.6 percent, inventories at 36.9 percent and land at 19.0 percent.[22] Property taxation and the spread between commercial/industrial and residential rates can have important implications for business investment and location decisions. This is particularly - but not exclusively - the case in many one industry towns in BC's regions. Careful assessment of appropriate levels and spreads between various property tax categories is warranted.

Table 5: Combined Federal and Provincial Tax Rates 2005

	Top Marginal Rates (%)			Ranks for Top Marginal Rates		
	Salary & Interest	Capital Gains	Dividends	Salary & Interest	Capital Gains	Dividends
Federal	29.00	14.50	19.58	n/a	n/a	n/a
BC	43.70	21.85	31.58	2	2	4
AB	39.00	19.50	24.08	1	1	1
SK	44.00	22.00	28.33	3	3	2
MB	46.40	23.20	35.08	4	4	8
ON	46.41	23.20	31.33	5	4	3
QC	48.22	24.11	32.81	8	8	6
NB	46.84	23.42	37.26	6	6	9
NS	48.25	24.13	33.06	9	9	7
PE	47.37	23.69	31.96	7	7	5
NF	48.64	24.32	37.32	10	10	10

Source: KPMG (2006)

On the ***personal tax*** side, high marginal personal tax rates – the amount taxed on the last dollar earned – discourage workers from working more and provide little incentive for those in the non-market economy to seek market work. Spikes or plateaus in the personal marginal effective tax rate are caused by claw-backs of tax credits and income tested government services, which can mean marginal effective tax rates of 60 percent at some levels (for every new dollar earned, 60 cents is clawed back either in taxes or in services).[23] Depending on the person, the spikes and plateaus hit at different income amounts in Canada; for a family with two children, the provincial average effective marginal tax rate peaks at more than 60 percent at an income of $25,000 to $35,000, for a senior with interest income, the marginal rate spikes to almost 80 percent at an income level slightly less than $25,000.[24] As outlined in Table 5, among the provinces, BC has the 2nd lowest top marginal personal income tax rate at 43.7 percent, behind Alberta's 39.0 percent. BC also has the lowest personal income tax rates in Canada for the bottom two tax brackets.[25]

Much like uneven corporate taxes, sector and/or industry specific ***subsidies*** can hamper competitive markets by propping up less competitive and often less productive firms. Subsidies directed at domestic firms unable to compete on a global scale counteract the productivity growth benefits that come from free market competition – the inherent and continual incentive for increasingly efficient production, adoption of new technologies and processes, and the growth of more productive domestic industries.

The ***opening of national borders*** – both to investment and to people – has been proven em-

pirically by researchers to boost productivity on a national level. A 2005 Statistics Canada study found that within the Canadian manufacturing sector, foreign-controlled firms are more productive, more innovative, more technology intensive, pay higher wages and use higher skilled workers. A further finding is that there are "productivity spill-overs" from foreign-controlled plants to domestic-controlled plants arising from increased competition and increased use of new technology among domestic firms. The stronger economic performance of the foreign-controlled firms was due in large measure to their multinational orientation, not because they were foreign-controlled.[26] Of course, this also suggests that Canadian manufacturing firms could increase their economic performance by becoming multinational enterprises. Opening borders to trade also encourages transfer of knowledge, technology, and best practices throughout jurisdictions. Canada, as a small, open economy, has benefited enormously from foreign technologies and the know-how gleaned from increased trade and Foreign Direct Investment (FDI) during the late 1990s.[27] Trade openness is also important to productivity because it encourages the development of export-based companies, which tend to have higher levels of productivity than domestic or importing firms.[28]

Engaging in ***regulatory reform*** can lead to business costs that are more competitive on a global scale and businesses which have more to invest in productivity enhancing activities such as research and development, innovation, and commercialization of new technologies (as they spend less on regulatory compliance activities). Regulation in-and-of-itself doesn't mean low productivity and low productivity growth. For example, some of the most highly regulated countries of Western Europe – France and Belgium for instance – are also some of the most highly productive in terms of labour productivity measured as GDP per hour worked. However, since some regulations tend to enhance productivity while others slow its growth, how the regulatory system operates has a direct effect on productivity.[29] Building a balanced and effective regulatory structure can enhance investment and, in turn, productivity by providing a stable and predictable environment for investors.

Since 2001, British Columbia has engaged in two types of regulatory reform. First, the Deregulation Initiative reduced regulation by over one third and developed a regulatory checklist consistent with OECD regulatory reform guidelines. Second, the provincial government committed to performing detailed regulatory program reviews in oil and gas, the forest sector, several environmental regulatory program areas, regulation of the financial sector and regulation of public safety in a variety of areas.[30] Going forward, while there are several areas where regulatory reform can help contribute to productivity growth, the Progress Board sees a few areas as paramount from this perspective. First is environment and land use. This broad area of regulatory activity involves all three orders of government (federal, provincial and local). Further efforts to harmonize regulatory standards for greater investment certainty is required. Second, within the Lower Mainland (and elsewhere) greater alignment of land use and transportation planning powers is required. For example, local agencies could usefully rezone lands around Skytrain stations to increase density and provide more ridership for the system. Such measures are also consistent with building, healthy, vibrant and sustainable communities, while helping to ease congestion and improve the timeliness

of business supply chains (i.e., fluid movement of goods, services and people). Third, efforts should be taken to track and report on regulatory enactments affecting business activity under the Community Charter. Here, greater knowledge of regulations across local governments could help efforts to harmonize regulatory standards and improve certainty for investors. Finally, mindful of the provincial government's current sales tax review, the province should examine the feasibility of harmonizing the provincial sales tax with the federal goods and services tax to reduce compliance costs for business. In the forgoing examples (and there are certainly others), there is an overriding "public interest" in streamlining, aligning or otherwise harmonizing standards between various orders of government to increase productivity growth and to improve provincial standards of living.

Infrastructure includes primarily transportation, communication, and utility systems, and more broadly can involve health and public education facilities. In tandem with the abovementioned fiscal economic policy framework for productivity, the existence of healthy infrastructure is a necessary basis for productivity growth. In the same way that a fair, efficient tax and regulatory scheme allows for productive businesses to thrive, a solid infrastructure system – accessible ports, up-to-date highways and roads, efficient airports, accessible education and health care facilities, well-designed public transit, and dependable electricity – ensures BC business can reliably and efficiently deliver goods and services when and where they are demanded.

Related to public infrastructure, the stock of "public capital" has been estimated as contributing 18 percent of the overall business sector multifactor productivity growth in Canada over the period from 1961 to 2000. The magnitude of the contribution of public capital – including highways, waterways, and mass transit systems – varies significantly across industries, but is highest in directly related industries such as transport, trade and utilities while it is lower in primary industries, such as fishing and trapping and some manufacturing activities. Increases in public capital can lead to demand for private capital in all industries. Research has linked public investment to increases in private investment, another key productivity driver.[31]

Unfortunately, investment in infrastructure has been insufficient over the past few decades, leading many analysts to conclude that there is an overall "infrastructure deficit." Canada's all-government (federal, provincial, and local) infrastructure shortfall has been estimated at $125 billion for 2003, which could rise to $400 billion by 2020. A recent estimate of local government infrastructure (which represents more than 50 percent of all public infrastructure) put the shortfall at $57 billion in 2002, rising to $110 billion by 2027 if there is no action taken.[32] The cost of infrastructure investments makes selecting the most effective and beneficial projects crucial. However, determining which projects will be the most effective in triggering economic growth is by no means straightforward. Because of the private control of much communications infrastructure – such as telecommunications and internet systems – private investment in infrastructure is also fundamental to productivity growth.

Recent federal and provincial efforts to tackle a number of "gateway" projects in the Lower

Mainland and Prince Rupert are positive, productivity enhancing initiatives. These efforts should, wherever possible, include Transportation Demand Management Techniques (i.e., time and use pricing, tolls, HOV lanes, etc.) to maximize productivity gains from easing congestion and to improve goods, services and people movement. Longer-term efforts to enhance airports at key regional nodes and – to the greatest extent possible – upgrade to four lanes key North-South and East-West highways (i.e., Highways 1 and 97) are also key productivity enhancing measures.

Broad Determinants of Productivity Growth

Investment in ***physical capital*** such as equipment, machinery and structures is recognized in economic theory as a fundamental way of producing more goods and services without increasing work effort. Often referred to as *capital deepening* because workers have access to more and/or more productive machinery and equipment in production, investment in physical capital contributes both directly and indirectly to productivity growth.

A 2001 OECD analysis of per capita output growth across 21 OECD countries over the period 1971-1998 estimated that the accumulation of physical capital, measured as the ratio of investment in machinery and equipment to GDP, raised long-run per capita GDP growth by 1.3 to 1.5 percent for every 1 percentage point increase in investment. A 2002 US report estimated that approximately three-quarters of the acceleration in labour productivity in the US non-farm business sector from 1996 to 2001 could be attributed to investment in capital, primarily in high-tech equipment. In Canada, productivity measures produced by Statistics Canada (see Table 6) show that increased capital deepening accounted for about 30 percent of the increase in labour productivity in the business sector over this same period, 1996 through 2001 (0.7 of 2.5 percent labour productivity growth). In recent years, a decline in capital intensity due to weaker growth in capital investment over the period 2001-2004 seems to have had a negative effect on labour productivity growth.

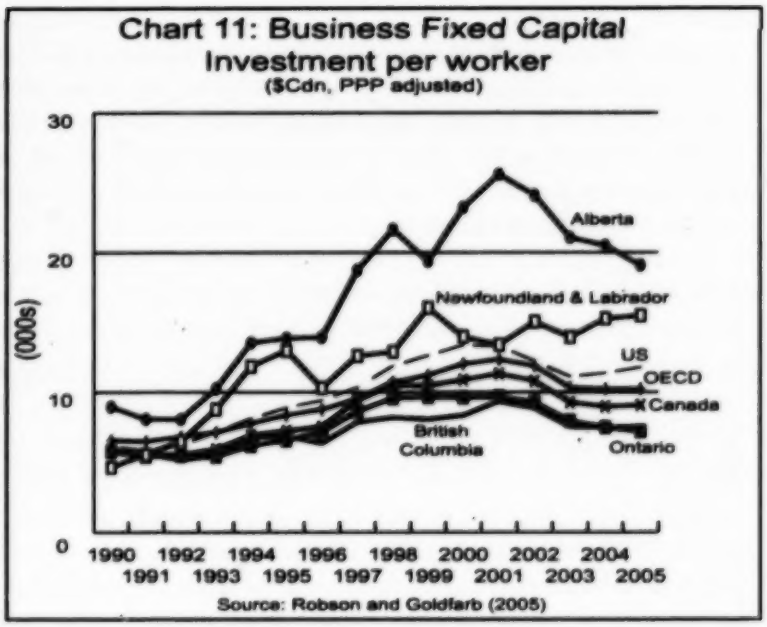
Table 6: Average Annual Growth of Business Sector Labour Productivity and its Components (in percent, compound annual rate), Canada

	1982-2000	1982-1990	1990-2000	1996-2000	1996-2001	2001-2004
Labour Productivity	1.5	1.2	1.8	2.8	2.5	0.8
Multifactor Productivity	0.5	0.2	0.8	1.8	1.6	0.9
Weighted Capital Intensity	0.7	0.6	0.7	0.7	0.7	(0.3)
Weighted Labour Quality	0.4	0.5	0.3	0.2	0.3	0.2

Source: Statistics Canada, CANSIM Table 383-0016

On a Canada-wide scale, business investment in physical capital per worker since the 1980s has declined relative to OECD countries on average. While North America as a whole has raised its share of gross investment within the developed world, Canada's share relative to the United States has fallen off significantly. In 1990, the gap between US and Canada investment per worker was $184, but by 1995 it had grown to $1,657. In 2005 it stood at $2,693, or more than 14 times the size of the 1990 gap (see Chart 11).

Within Canada, British Columbia ranked 6th for business investment per worker for 2005, down from 3rd in 1990. Alberta held the top spot over the entire period 1990-2005, with investment per worker that was 2.5 times that of BC in 2005, or $19,079 versus $7,506. Investment per worker in Newfoundland and Labrador trailed BC by $1,246 in 1990, but was almost twice that of BC in 2005. Internationally, BC's business investment per worker was 73 percent of the OECD average in 2005, and 64 percent of the US for the same year demonstrating that even in recent times the province has underperformed.



The level of labour force ***education and skills*** significantly impacts a jurisdiction's ability to quickly adapt and use new technologies and best practices to innovate and to work more effectively and productively. There are two ways investments in education and skills[33] are thought to facilitate growth. First, higher skilled workers are likely to transfer their knowledge to others, and therefore improve the general skill level in their workplace, a kind of "knowledge spill over" effect. Second, those with higher skills and education are integral to the production of new technology through innovation, a driver of productivity growth discussed in more detail in the following section. The link between skill and education investment and labour productivity growth is an intuitive concept – a higher educated, more skilled worker can teach their co-workers, and will likely be more productive and more innovative in their own work.

Growth in productivity and increases in knowledge and education are often presumed to be positively correlated; human capital growth through education and training is argued by many economists to be integral to increasing productivity. Focused cross-country studies link increases in average educational attainment over long periods of time in a particular country to long run improvements in output per capita.[34]

As an input to productivity, skill level is often measured by the average formal education attainment and/or the average experience of a workforce. These measures describe a general sense of growth over time, but don't capture possible deterioration in labour quality due to external factors, such as a possible decline in the difficulty of standardized tests,

which could cause productivity growth (and actual labour quality growth) to wane despite perceived growth in labour quality.[35] Investments in skills and education includes anything from basic skill development (K-12 schooling, for example), to trades training, university education, and on-the-job training and employee development.

Looking specifically at basic skill development, comparing results of OECD countries on the International Adult Literacy Survey (IALS) which tests literacy in prose, document and quantitative analysis is instructive. Raising literacy scores by one percent relative to the international average is associated with an eventual 2.5 percent rise in labour productivity. Canada's performance on the IALS was middling among OECD countries, and low compared to competitor countries. Performance was especially low for those without a high school diploma in Canada compared to other OECD nations.[36] Similarly, several knowledgeable observers[37] argue that focusing on developing the basic skills of low-productivity workers through improving the basic education system and focussing on adult skill development, should be the primary "human capital" investment strategy for increasing labour productivity. This approach to education and skill development can be described as the "push-up" method – Canada and BC can improve their overall labour productivity levels by "pushing up" the bottom level performers.

British Columbia's track record on "push up" areas has generally been positive, although there is always room to improve provincial performance. Overall, the province had a high school completion rate of 79 percent for the general population, and 48 percent for the Aboriginal population in 2004. A 2002 BC Progress Board report set benchmarks for the province of 85 and 60 percent respectively for both groupings by 2010.[38] At the half way mark in 2006, BC is on its way to reaching these targets, though concerted effort will be required over the balance of the decade. Of some concern is that – at 79 percent two years in a row – the general completion rate may have stalled. From a productivity and student performance standpoint, further provincial efforts to smooth out regional variations in completion rates are needed together with continued measures to "close the gap" between Aboriginal and general completion rates and female and male performance. On the quality front, BC ranks favourably on standardized tests of math, science, reading and problem solving, ranking an average of 4th out of 41 OECD jurisdictions in 2003 Performance for International Student Assessment (PISA) test results.[39]

Another way skills and education is argued to increase labour productivity is through "pulling-up" productivity levels by increasing the amount and quality of higher education at the undergraduate and post-graduate levels, through investment in post-secondary education. More specifically, PhD graduate research, spin-off companies, and commercialization of research-generated ideas are generally productivity enhancing. This "pulls up" labour productivity in two ways. First, workers with a university education are correlated to more innovative firms, and therefore contribute to higher firm-level labour productivity levels.[40] Having more participants in the labour force with a university education (and consequent higher labour productivity levels) boosts labour productivity by pulling up the average in a jurisdiction. Second, investment in masters and doctoral students (especially those in natural

and applied sciences) pulls up the average both by training highly productive knowledge workers, and through product and process innovation. This innovation over time translates into higher overall productivity levels both through general purpose technologies like computers, and through more specific advancements such as industry-specific software and applications.

While Canada currently has a higher proportion of the population with some post-secondary education than the US (40% compared with 35% in 2001[41]), it has a lower percentage of those 25 and older with bachelor degrees and above (19.7% in 2005 compared to 27% overall in the United States). Within Canada, British Columbia places 2nd amongst the provinces with 19.9 percent (Ontario is first with 22.6%); however, it places 48th among 61 subnational jurisdictions in North America and stands above only four states: Nevada (19.3%), Kentucky (19.0%), Mississippi (18.9%) and West Virginia (16.3%). Closer to home, Washington State had a rate of 31.3 percent in 2005, while Oregon was 27.7 percent, and California was 29.4 percent.[42]

Canada also has a lower share of the population with a doctorate, at 0.8 percent compared to 1.3 percent in the US.[43] A Statistics Canada survey of Canadian doctoral graduates over the period July 1, 2003 to June 30, 2004 found that one-fifth of all graduates intended to leave Canada in the year following graduation. Of those intending to leave Canada, 42.4 percent were in life sciences (agricultural, biological and health), 21.1 percent were in the physical sciences (computer science and mathematics, chemistry and other physical sciences), 10.3 percent were in the social sciences, 10.0 percent were in engineering, 9.4 percent were in humanities, and 6.9 percent were in other fields of study. Notably, over 60 percent of foreign students – a group one might expect to be behind the numbers who leave post-graduation – planned to remain in Canada upon graduation.[44]

Of growing concern and importance for enhancing productivity in both Canada and British Columbia is ensuring an adequate proportion of the labour force is trained in trades and vocational occupations. In 2004, 10.6 percent of Canadians aged 15 and older had recognized trades training. The average was a slightly higher 11.5 percent in BC, while the province placed well back of Alberta's 13.8 percent.[45] Notwithstanding BC's higher than national average performance on this important metric, the province's fast growing economy and the demands of demographic change are placing significant challenges on many employers, especially within BC's booming construction sector. The province needs ongoing and concerted efforts to increase skilled labour now and over the balance of the decade. Addressing these challenges will require a multi-faceted approach which could include all of the following measures. First, there is a need to advise young people of the merits of pursuing trades and vocational training within the high school system through programs such as the Accelerated Credit Enrolment in Industry Training (ACE IT) initiated in 2004/05.[46] Part of the relative gap in trades training with Alberta may be attributable to the fact Alberta's Registered Apprenticeship Program (RAP) in high schools has been in place since 1991.[47] Second, the average age of trades-persons in BC is around 48 years typically.[48] One low-cost idea is for industry and government to provide younger workers with mentorship to,

at once, provide applied skills training and to ameliorate some of the effects of age-related declines in individual worker productivity. Third, ongoing efforts to accelerate the participation of Aboriginals, women, and wherever possible, persons with disabilities, should be taken. Finally, the provincial nominee program and other immigration measures should be leveraged to the greatest extent possible to help address skill shortages in key areas. The importance of focussing on immigration is underscored by the fact that Canada has become increasingly dependent on immigration as a source of population growth. In recent years this dependence has increased to the point where, between 2000 and 2005, net international migration to Canada accounted for the majority (65% on average) of population growth.[49] As the existing population continues to age population growth will become even more closely tied to immigration rates. In fact, immigration is predicted to account for all net labour force growth in Canada by 2011 and all net population growth by 2031.

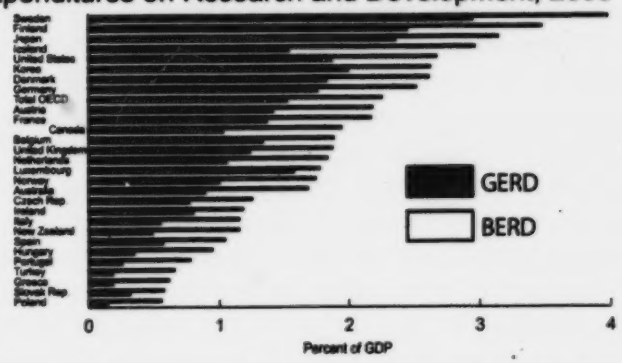
Innovation and Commercialization is commonly understood as the introduction and popularization of new production processes often through new equipment, generating more goods or services without increasing the amount of factor inputs such as labour and capital. A strong productivity-supporting government policy foundation combined with investments in skills and education and physical capital by the business sector creates a healthy environment for innovation by encouraging research and development (R&D), which leads to the commercialization and popular adoption of new processes using more efficient products. Innovation is often regarded as the principal determinant of productivity growth over time as it not only causes direct increases in productivity through the use of the new technology, but it encourages future human capital development as well as further innovation based on new, more advanced technology. As well, technological development is a seemingly infinite source of growth.

Analysis done by the OECD on multifactor productivity growth in 16 OECD countries over the period 1980-1998 confirms a positive correlation between R&D expenditures and productivity performance, linking a one percent increase in business, public and foreign R&D to a 0.13, 0.17 and 0.44 percent increase in productivity respectively. The study also underlined the linkages between public and private R&D – the effect of public research is higher in countries with a higher intensity of business research – as well as the importance domestic firms have for the capacity to recognize and adopt foreign technologies as effectively as they do those of domestic origin.[50] There is also a positive relationship amongst all stages of the innovation process, including research, development, and the patenting and implementation stages.[51]

Among OECD countries, Canada ranks 15th for the level of business expenditures on R&D (BERD) and 11th in terms of gross domestic expenditures on R&D (GERD), which means Canada not only has low relative R&D intensity, but also has a relatively low share of R&D carried out by business.[52] Relatively small countries like Sweden and Finland have a higher level of both BERD and GERD and a larger share of R&D done by business (see Chart 12). Indicators for R&D personnel and patents filed provide a similar picture, with Canada having solid growth rates, though they are lower than many similarly developed countries.

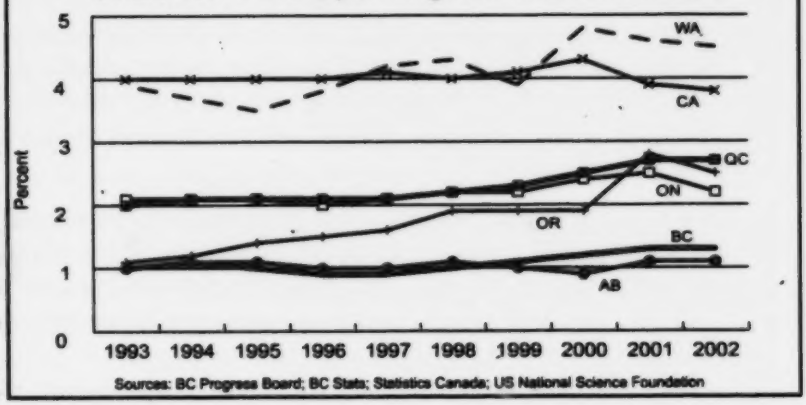
Within Canada, British Columbia and the other western provinces have historically and continue to spend less as a percent of GDP on R&D than Ontario and Quebec. BC has the most service-oriented economy among the provinces which – along with the fact that service industries have relatively low R&D intensity[53] – may explain a large part of the differences noted. In 2002, gross expenditures on R&D in British Columbia were 1.34 percent of GDP compared to 2.25 percent in Ontario and 2.69 percent in Quebec. Compared with West Coast US states, British Columbia performs even worse, with Washington State and California spending about four percent of GDP on R&D in 2002 (see Chart 13). In 2001, business expenditures on R&D were under one percent of GDP in British Columbia, while they were over 1.6 percent in both Ontario and Quebec.

Chart 12: Business (BERD) and Gross Domestic (GERD) Expenditures on Research and Development, 2003



Source: OECD Note: GERD from 2002 for: Australia, Italy and Turkey; BERD from 2002 for Austria and Turkey

Chart 13: R & D Spending as a Percent of GDP



Sources: BC Progress Board; BC Stats; Statistics Canada; US National Science Foundation

The Lower Mainland in BC has much of the infrastructure needed to support R&D intensive business, including world-class universities, a skilled labour force, attractive cities, and close proximity to the technological clusters in the western US.[54] BC educational institutions have effectively leveraged research funds as measured by the relative performance of the province on patent creation and disclosures. For example, with funding of $471 million in 2003 (or 11% of the total Canadian post-secondary research funding), BC post-secondary institutions generated 19 percent of all inventions disclosed and 25 percent of all spin-off companies created, and the province registered the highest return on investment in terms of intellectual property commercialization.[55] Clearly, this is a key strength on which to build

future productivity gains in British Columbia. Moving forward though, increased attention should be paid to measuring the impact that research is having on actual firm level productivity in order to further test the efficacy of research expenditures.

Specific, Industry- and Firm-Level Productivity Growth Determinants

Economies of scale at a firm level are an important source of productivity growth. Larger companies or organizations can produce goods and services more cheaply, using fewer inputs than smaller ones. Scale economies relate to productivity growth in that larger companies with larger output levels and subsequently a greater ability to invest can afford to deploy new technologies to deepen their capital because the relative cost is lower. Further, a larger firm has higher production volumes to ensure new, higher capacity capital is used to maximum efficiency once the investment is made. By using the new capital, the individual worker at a larger firm is able to produce more output than his or her counterpart at a smaller firm. Large firms are more likely to be exporters[56] and tend to be more productive than domestic or importing firms.

Larger firms and organizations also often have greater ability to invest in employee training – both due to larger profit margins allowing for long-term investments and because a large, highly specialized labour force often means each individual is less integral to everyday operational matters and therefore is able to take time off from production to develop new skills. Benefits of economies of scale can ripple into other determinants of productivity growth, encouraging improved human capital and, more indirectly, innovation. Larger companies and organizations are also sometimes affected by diseconomies of scale, which relate to the escalating management costs in large organizations, or the disproportionate costs of dealing with large scale externalities – environmental waste for example – that don't affect smaller businesses.

It is important to note that both Canada and British Columbia are characterised by small and medium-sized enterprises (SMEs) more than key competitors. The contribution of small businesses to BC's GDP was 26 percent in 2004, the highest proportion in the country and well above the national average of 22 percent.[57] Canada's smaller size with a greater incidence of smaller firms relative to the US "serves to constrain Canada's productivity relative to the United States".[58] Yet innovation is often strong at the small business level, and innovative small firms often become larger enterprises. A study of Taiwanese firms found that it is not necessarily size that determines productivity levels and growth, but rather productivity levels and potential that encourage a firm to grow. This relationship has a virtuous cycle, meaning as productive firms grow they obtain economies of scale allowing greater access to resources and information which enables them to be more productive. This study credits Taiwan's low entry and exit costs as a key driver of higher productivity, as it encourages market mechanisms that weed out low productivity firms while facilitating the entry and growth of high productivity firms.[59]

The ***organization*** of a company or industry can contribute to productivity in many ways,

including: adoption and use of general purpose technology,[60] and more specific technology, managerial policies, staffing, and knowledge management practices.

Knowledge management strategies at the firm level have been found to drive productivity:

- Firms that implement incentive policies to keep executives and employees and those that forge alliances or partnerships for knowledge acquisition have a higher propensity to innovate;
- Firms with a written knowledge management policy have higher innovation intensity;
- Firms that implement an incentives policy to retain executives and employees have a higher propensity to patent; and,
- Firms stating they promote knowledge sharing and have an incentives policy to retain executives and employees have higher labour productivity levels than firms that did not.[61]

In general, knowledge management and employee retention strategies have a positive impact on innovation and on labour productivity levels of a firm.

Organization can also be important in terms of how an industry is dispersed or concentrated throughout a particular jurisdiction. The concentration of a high-skilled industry in one geographic location encourages mobility and ease of transfer of both human capital and best practices. For example, in the IT hub of Silicon Valley costs of information, knowledge and skill transfer are smaller, and the transfer time for innovation is less than when an industry is geographically scattered. The Ontario Institute for Competitiveness and Prosperity has argued that "cluster content" is a determinant of firm level and further aggregate productivity.[62] Considerably more research is needed into quantifying this effect within the British Columbia context.

The importance of ***information and communications technology*** **(ICT)** investment to productivity growth has been discussed elsewhere in this paper, but deserves special attention in its own right. It is well recognized that an acceleration of investment and diffusion ICT is the fundamental reason for labour productivity growth in both the United States and Canada during the last half of the 1990s. But while Canada has experienced growth in ICT investment, it has not kept pace with levels in the United States. Indeed, business sector investment in ICT in Canada fell from 74 percent of US levels in 1987 to 66.1 percent in 2004.[63]

A host of factors account for the apparent gap in ICT between Canada and the US, including: under-measurement of the ICT investment due to lack of information in certain industries; an industrial structure where ICT intensive finance and insurance industries are less prevalent in Canada than in the US; the greater presence of small and medium sized enterprises in Canada relative to the US which typically invest much less in ICT than large firms; lower levels of formal education attainment by Canadian managers relative to US counterparts; lower labour costs in Canada provide less incentive substitute ICT; and, high marginal effective tax rates on ICT assets in Canada which acts as a potent disincentive to new investment, especially in Ontario and British Columbia.[64]

Given the importance of ICT to firm-level productivity growth, governments should focus efforts to encourage the diffusion and adoption of technology. Indeed policy measures aimed at the diffusion and popular adoption of ICT is likely to have an equal or greater impact than measures focusing on research and development alone. In this regard, though the recent provincial budget included targeted relief for provincial sales tax (PST) on ICT investments, elimination of PST for ICT altogether[65] would serve as a useful productivity enhancing measure.

The level of productivity and possibility of productivity growth in a particular jurisdiction is related to the ***types of industries*** that comprise an area, and the share of the labour force that works in each industry. Some industries have high labour productivity (GDP per hour worked) while others lag behind. That means growth in a jurisdiction's overall productivity could come from workers transferring from less productive industries into more productive ones, without any change in the productivity level of either industry. Focussing on the development of highly productive sectors is usually a key to growth of overall productivity. Yet, the sectoral mix of a particular jurisdiction often depends on natural resources, for example, and is not entirely flexible.

An example of how low productivity in one area can "pull down" overall productivity levels is explored in a Statistics Canada study of self-employment in Canada.[66] The study links the growth of self-employed with no employees to the decline in Canada's labour productivity levels relative to the US over the 1990s. Self-employment accounted for 55 percent of total net job growth in Canada from 1990 to 1998, driven by those classified as self-employed without staff. This group earned less than both the self-employed with employees and those in paid employment, and had the lowest level of labour productivity and labour productivity growth in Canada. In contrast, the self-employed in the US have higher productivity and labour productivity growth. Canada's real labour productivity growth gap relative to the US from 1990-1998, once the self-employment gap is removed, is insignificant. This raises questions again about appropriate level of tax rates in Canada and British Columbia relative to other jurisdictions (particularly the United States) and the incentive effect this has on workers choosing to eschew paid-employment in favour of self-employment, and their impact on business investment and location decisions in British Columbia. On average over the period 1996 through 2005, 19.1 percent of BC's employment was classified as self-employed. This was second only to Saskatchewan at 22.9 percent, and well above the national average of 16.0 percent.

V. FIVE AREAS FOR BUILDING A 'CULTURE OF PRODUCTIVITY'

BC currently has mediocre productivity performance in comparison with other provinces, the national average and relative to many OECD jurisdictions. In order to effect further improvements in material living standards in British Columbia, public and firm-level policies and practices must continuously be reviewed for their contribution to making BC more productive. Productivity is a very complex topic and there is not complete agreement among experts on precise prescriptions to improve performance. And it is important to remember that investments which are likely to yield productivity improvements can take some time to payoff. Having said this, in the BC context there are a variety of practical suggestions which policy makers and firms can consider to help boost overall productivity performance over time. Based on previous work and analysis within this report, the Progress Board suggests that broad efforts can usefully be concentrated in five areas: tax policy; trade barriers, openness, and immigration; regulatory reform; public infrastructure; and, skills, education and research.

- **Tax Policy**
  - Ongoing efforts to shift the tax burden away from investment with continued efforts to lower the marginal effective tax rate on capital investment are imperative. On the international scale, top economic growth performers such as Singapore and Ireland have much lower rates. Within Canada, a low marginal effective tax rate on capital has helped propel productivity growth in Newfoundland and Labrador between 1997 and 2004.
  - Mindful of the provincial government's current provincial sales tax review, the province should examine the feasibility of harmonizing the provincial sales tax with the federal goods and services tax to reduce compliance costs for businesses as well as eliminate sales tax on business inputs.
  - Provincial corporate taxes should continue to be neutral to all industries to ensure the competitive market can function effectively to encourage the growth of highly productive sectors and firms.
  - Efforts to review the impact of the provincial property tax regime on industrial competitiveness, particularly within the province's regional economies should be a priority.

- **Trade Barriers, Openness, and Immigration**
  - Ongoing efforts to reduce international and remaining inter-provincial barriers to trade should be a priority. Though few, remaining inter-provincial barriers that limit labour mobility should be eliminated. These include:
    - Areas of limited transferability of work-related benefits; and,
    - Professions for which there are no mutual recognition agreements of qualifications between provinces.
  - Programs aimed at integrating new skilled immigrants into the British Columbian workforce should be encouraged, including:
    - Credential assessment programs that assist employers in evaluating foreign education and training;

        - Bridge programs to "top-up" immigrant skills and language training, among others; and,
        - Leverage, to the greatest extent possible, the provincial nominee program to help address existing and prospective skilled trade shortages.
    - Further proactive efforts by both British Columbia and federal authorities to address visa processing challenges to encourage foreign students to study and stay in Canada should be a priority.
    - Further efforts by federal authorities to develop more multi- and bi-lateral trade agreements, like NAFTA to further integrate BC and Canada into the global economy should be a priority.

- **Regulatory Reform**
    - Coordination and wherever possible harmonization of regulatory standards across agencies within government and across all orders of government (federal, provincial, local) should be aggressively pursued.
    - While past reforms have targeted a reduction in the quantity of regulation, future reforms should aim to improve the quality of regulation to ensure minimal impacts on the efficient functioning of markets and productivity growth.
    - Efforts should be targeted initially at high impact areas including land use and environmental regulation.
    - The province should track and report regularly on regulatory enactments made by local governments under the Community Charter.
    - Similar to efforts in other provinces, BC's mandatory retirement policy should be reviewed.

- **Public Infrastructure**
    - Because most infrastructure is managed at the local level (more than 50%), the province should continue to work with local governments to target the most necessary and urgent projects in terms of their ability to boost provincial productivity.
    - Federal and provincial authorities should continue investments in critical Airport infrastructure province-wide particularly in selected urban and regional nodes where such investments can have transformative effects from both passenger and cargo standpoints.
    - Consistent with past Progress Board policy suggestions, the province and federal government should continue efforts to four-lane key North-South and East-West highway infrastructure, particularly the Trans-Canada and Highway 97 from Prince George to the Canada-US Border
    - Planned provincial and federal gateway transportation improvements in the Lower Mainland (port, roads, rail, and air) should be continued, twinned wherever feasible with Transportation Demand Management techniques to improve the flow of consumer goods and services and people.
    - Efforts should be taken to align regional transportation and land use planning (zoning) to increase ridership on Skytrain lines, while furthering productivity and sustainability within the Greater Vancouver Region as a whole.

- **Skills, Education, and Research**
  - Continue to focus on early childhood education to ensure the next generation is prepared to fully contribute to the province.
  - Continue to focus on enhancing adult basic literacy.
  - Provincial authorities should develop and make widely available materials outlining productivity enhancing measures that individuals and firms can implement in their daily lives, including but not limited to: incentive and bonus schemes, use of more flexible work arrangements, and adjustments to pension provisions to provide incentives for working past age 60.
  - Continue to focus on achieving a leadership position relative to other provinces in terms of provincial high school completion and test results, including:
    - Pay particular attention to reducing performance outcome gaps between Aboriginal students and the general student population;
    - Address growing student performance gaps between female and male students; and,
    - Smooth out regional variations in performance outcomes.
  - Focus on Post-Secondary Education and Research
    - Focus on maintaining British Columbia's leadership position with respect to the percentage of persons of working age with a post-secondary credential;
    - Focus on increasing British Columbia's provincial graduate student enrolments generally and those in applied sciences and engineering disciplines in particular;
    - Continue concerted efforts to address skilled trade and other worker shortages through training, immigration and other means;
    - Continue efforts to encourage firm level adoption and diffusion of information and communications technology;
    - Continue efforts to improve British Columbia's relative performance on public and private research and development expenditures;
    - Develop and aggressively pursue a province-wide strategy to commercialize research from BC's post-secondary institutions; and,
    - Examine and act on areas where the province can benefit most from the integration of foreign credentialed immigrants into the provincial workforce.

British Columbia needs to become seized with building a "culture of productivity" as a collective provincially, in public policy decisions of all orders of government, within business planning and daily decision making by firms and organizations, and within our own decisions as individual citizens. British Columbia has a mediocre track record in boosting its productivity performance. The reality of demographic change and its consequences for provincial labour markets in the coming decade suggests that "pulling out all the stops" to boost BC's productivity levels must be a provincial priority.

ANNEX 1: DEFINING AND MEASURING PRODUCTIVITY

Productivity measures the resources used in production activities relative to the output of those activities for a certain economy and can be measured widely, for all of Canada or an entire industry, or narrowly, for a particular company or for an individual. Productivity indexes universally express output – produced goods and services – in terms of input. This general definition produces different measures of productivity depending on what measure of output and variables for input are used. International comparisons of productivity are usually made using real GDP per capita because there is limited comparable data to produce a more sophisticated measure. Real GDP per capita is a simple, economy-wide measure of average labour productivity. However, while international comparisons are often forced to rely on real GDP per capita, single economy analyses can utilize additional data to analyse productivity.[67]

Productivity is measured and compared in two main ways:

1 – **Labour Productivity** is measured as GDP per capita, as mentioned above, as GDP per worker, or, most commonly, as GDP per hour worked. Labour productivity is a ratio of output to a single measurable input, labour. Labour productivity is known as a partial productivity measure.

2 – **Total Factor Productivity (TFP)** is similarly a ratio of output, GDP, with respect to input, but TFP measures all the resources used in the production of goods and services – all inputs.[68]

$$\text{Labour Productivity} = \frac{\text{Quantity of Output}}{\text{Quantity of LABOUR Input}}$$

$$\text{Total Factor Productivity} = \frac{\text{Quantity of Output}}{\text{Quantity of TOTAL FACTOR Input}}$$

Growth in productivity is measured by comparing productivity levels – either labour or total factor productivity – over a period of time. Because productivity growth is cyclical and fluctuates in line with the business cycle, (this phenomenon is further explained in Annex II) productivity growth is more accurately captured when growth figures are compared at the same point in the business cycle over a longer period of time.[69]

Labour productivity is easily and directly measured using GDP data and information about the labour force. Not only can we measure labour productivity growth by comparing it over time, but we can also calculate a quantified representation of labour productivity at a point in time – GDP per hour worked. The Progress Board uses real GDP per hour worked in the business sector as its productivity performance indicator as part of its Benchmarking reporting for inter-provincial comparisons and to analyze growth in overall productivity.

Total Factor Productivity growth is calculated residually; it is measured by subtracting the

growth rate of the known inputs, such as capital and labour, from the measurable growth in output, GDP.[70] Therefore, TFP represents the immeasurable components – the residuals – that contribute to GDP growth. Traditionally, economists thought TFP represented the growth rate of technological innovation; now researchers in productivity disagree on exactly what comprises TFP:

1. The conventional view says TFP growth equals the rate of technical change that has yet to be integrated directly into labour and/or capital, and is therefore both a contributor to current growth and a good predictor of future growth in labour and capital.
2. A second view holds that TFP is an estimation of the indirect growth that comes from technological improvements – for example, a rise in incomes not of those incorporating new technologies, but, on a longer term scale, for individuals in the economy at large.
3. A third view suggests TFP, as a residual measure, simply represents what we don't know about economic growth.[71]

Since it uses a longer, more complex set of input data, TFP growth data is reported less often and with a longer time delay than labour productivity data. However, TFP is an important measure of productivity in that it takes into account all inputs that contribute to production. Included in this, says the traditional view, are technologies that have yet to be integrated into labour practice but may stimulate future growth in labour productivity and economic growth.

In deciding which measure of productivity – labour or total factor – to use to compare productivity levels and growth, one must take into account the strengths of each. Many analysts agree that labour productivity is best for cross-country comparisons, where statistical procedures to determine capital depreciation and aggregation (inputs in calculating total factor productivity) may vary. As well, as argued by Sargent and Rodriguez, because of the mismatch in grow rates of capital intensity and TFP, labour productivity may give a more accurate representation of productivity over periods of a decade or less, where TFP may be a better predictor of longer run trends.

ANNEX 2: MEASUREMENT – BUSINESS CYCLE AND CAPACITY UTILIZATION

Productivity growth is pro-cyclical, meaning it tends to decline below its average longer-term level during economic downturns and rise above this trend during upturns. More simply, growth in productivity declines in economic recessions and increases in booms. In order to measure the underlying trend in labour productivity growth, it is necessary to mitigate or eliminate this short-term fluctuation from the long-term trend. This is typically done by calculating productivity growth rates at comparable points in the cycle, such as from peak to peak or trough to trough.

One major explanation for this effect in measured labour productivity is the slow adjustment of labour input to changes in the level of output. It is costly for firms to acquire skilled workers; therefore, during downturns, firms initially hoard labour, resulting in a short-term decline in labour productivity as the output produced goes down but the number of employees remains the same. When economic conditions recover, firms have sufficient excess labour; initially, they are able to meet rising demand without hiring more workers. Productivity rises as more output is drawn from the existing workforce. Uncertainty about the strength and duration of the recovery may delay firms from hiring new workers and building new capacity, thereby prolonging the increase in labour productivity.

Three other explanations for the fluctuating nature of productivity growth are:

- Technology shocks – cyclical productivity increases may mirror the booms and busts of technological innovation, especially considering one direct component of total factor productivity is improvements in technology.
- Imperfect competition – coupled with increasing returns, imperfect competition across an industry may mean productivity will rise whenever there is an increase in inputs.
- Reallocation of resources – sectors with higher marginal products for their inputs will exacerbate productivity growth as output increases, and, as output decreases, productivity decreases will be magnified.[72]

Appendices

A. Board Members, Staff, and Advisory Group Members

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C. Notes

[1] Harchaoui and Tarkhani (2005), page 5

[2] BC Progress Board (2005a), pages 36-38

[3] Note: all data in this section are from the database of the Centre for the Study of Living Standards, accessible at: http://www.csls.ca/data/ptabln.asp, last updated June 14, 2005.

[4] TD Economics (2005a), page 5

[5] See Annex 1 for a discussion of the differences between labour productivity and total factor productivity.

[6] BC Stats (2005a), page 2

[7] Conference Board of Canada, (2004) page 70

[8] Ibid, page 69

[9] For further information on labour and total factor productivity measures and issues, please refer to Annex 1.

[10] Orr (2005), pages 3-4

[11] Including – Population booms and busts, retirement trends and levels, immigration, skill shortages, among others.

[12] Orr (2005), page 4

[13] Harchaoui and Tarkhani (2005), page 5

[14] Sharpe (2003), page 3

[15] Finlayson and Peacock (2006), page 1

[16] Kittredge (2005), pages 2-3

[17] For example: Sharpe (2005), Department of Finance, Canada (2004), Rao et al. (2001) and Steindel and Stiroh (2001).

[18] For instance, Harris (1999)

[19] Sharpe (2005)

[20] Harris (1999), page 15

[21] Mintz et al (2005), pages 7-9

[22] Ibid (2005), page 10

[23] Institute for Competitiveness and Prosperity (2005a), page 9
[24] Mintz et al (2005), pages 12-13
[25] Government of BC (2006), page 4
[26] Baldwin and Gu (2005), pages 6-9
[27] Rao, Sharpe and Smith (2005), page 14
[28] Harris (1999), page 15
[29] TD Economics (2005a), page 11
[30] BC Progress Board (2005b), pages 12 & 25
[31] Harchaoui and Tarkhani (2003), pages ii - v
[32] Estimates listed in TD Economics (2004), page 4
[33] This productivity driver is often referred to as "human capital" by economists and productivity theorists. See, for example, Harris (1999).
[34] Bassanini and Scarpetta (2001), page 24
[35] Centre for the Study of Living Standards (1998), page 29
[36] Coulombe and Tremblay (2005), page 1
[37] See: International Productivity Monitor, Fall 2005, articles by Jackson and Fortin.
[38] BC Progress Board (2002), page 19
[39] BC Progress Board (2004), page 75
[40] Rao, Tang and Wang (2002), page 1
[41] Organization for Economic Cooperation and Development (2004), page 6
[42] BC Progress Board (2005a), page 80
[43] TD Economics (2005a), page 11
[44] Gluszynski and Peters (2005), pages 18-19 & 39
[45] BC Progress Board (2005a), page 79
[46] See Industry Training Authority (2005) for more information.
[47] See Alberta Apprenticeship and Industry Training Board (2005), pages 3 & 69 for more information.
[48] Skills Canada BC (2006)
[49] Unpublished Statistics Canada data. See BC Progress Board (2005a), page 69 for more information.
[50] Guellec and von Pottelsberghe de la Potterie (2001), page 3
[51] Jaumotte and Pain (2005), page 7
[52] Organisation for Economic Cooperation and Development (2005)
[53] Jaumotte and Pain (2005), page 12
[54] Harris (2005), page 9
[55] BC Progress Board (2005a), page 86
[56] Halabisky, Lee and Parsley (2005), page 28
[57] BC Stats (2005b), page 12
[58] TD Economics (2005), page 11
[59] Aw (2002) pages 69-70
[60] A general purpose technology (GPT) is "a major innovation which has widespread uses within the economy and whose introduction in turn leads to wholesale transformation of production and distribution systems with attendant innovation." Harris (1999), page 19
[61] Kremp and Mairesse (2003) pages 6-7
[62] Institute for Competitiveness and Prosperity (2005b), page 33
[63] Sharpe, (2006), pages 4-5.

[64] Ibid, page 6.
[65] Ibid, page 7. Beginning in mid-2001, production, machinery and equipment used by manufacturers and by companies in logging, mining, and energy were made PST exempt. BC Budget 2006 expanded this exemption to apply to businesses that provide manufacturing services to those manufacturers eligible for the exemption and clarified requirements to qualify for the exemption.
[66] Baldwin and Chowtan (2003)
[67] Harris (1999), pages 6-8
[68] Diewart (2000), page 45 lists the following as possible additional inputs: intermediate inputs; reproducible capital inputs; inventories; land; resources; working capital, money and other financial instruments; knowledge capital; and infrastructure capital.
[69] Steindel and Stiroh (2001), pages 18-19
[70] Centre for the Study of Living Standards (1998), page 7
[71] Lipsey & Carlaw (2001) pages 2-3 & 11-15
[72] Basu & Fernald (2000), pages 1-3

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